

FAHRENHEIT VS. CELSIUS

Suggested Grade

8

SD Mathematics Strand & Standard (*Primary for Task*)

Algebra

8.A.4.2. Students are able to describe and represent relations using tables, graphs, and rules.

Task Summary

Students create a mathematical model to convert normal body temperature from 98.6° F to Celsius.

Time and Context of Task

Two 50 minute class periods. Task should be attempted after students are able to model linear relationships with tables, graphs, and rules.

Materials Needed

Graph Paper

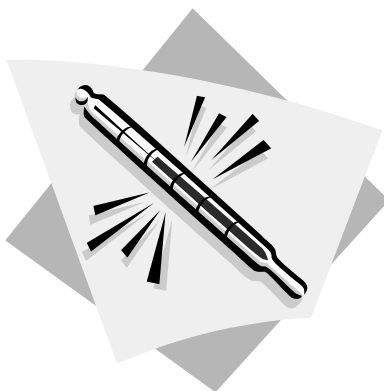
Author and Lead Teacher for this Task

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FAHRENHEIT vs CELSIUS

While traveling in Europe, you are exposed to a virus. One of the symptoms of the disease is running a fever. You “feel hot” and want to check your temperature. The only type of thermometer that is available at the local store is marked in degrees Celsius. You don’t know the normal temperature in Celsius, but do remember that water freezes at 32°F or 0°C and water boils at 212°F and 100°C . You must create a mathematical model to convert normal body temperature from 98.6°F to Celsius. Represent the mathematical model in a table, as a rule or an equation and graph the model. Calculate normal body temperature in degrees Celsius.



CONTENT STANDARDS

Primary Standard

Strand Name: Algebra

SD Goal: Students will use the language of algebra to explore, describe, represent, and analyze number expressions and relations that represent variable quantities.

Indicator: Describe and use properties and behaviors of relations, functions, and inverses.

Standard: 8.A.4.2. Students are able to describe and represent relations using tables, graphs, and rules.

Supplemental Standard

Strand Name: Algebra

SD Goal: Students will use the language of algebra to explore, describe, represent, and analyze number expressions and relations that represent variable quantities.

Indicator: Describe and use properties and behaviors of relations, functions, and inverses.

Standard: 8.A.4.1. Students are able to create rules to explain the relationship between numbers when a change in the first variable affects the second variable.

NCTM Process Standard

Problem Solving

- Solve problems that arise in mathematics and in other contexts.
- Apply and adapt a variety of appropriate strategies to solve problems.

Connections

- Recognize and apply mathematics in contexts outside of mathematics.

Problem-Solving Strategies

- Developing formulas and writing equations
- Drawing pictures, graphs, and tables
- Modeling

ASSESSMENT TOOLS

Task Rubric

Category	Advanced	Proficient	Basic	Below Basic
8.A.4.2. Students are able to describe and represent relations using tables	Data in the table is well organized, accurate, and easy to read.	Data in the table is organized, accurate, and easy to read.	Data in the table is accurate and easy to read.	Data in the table is not accurate and/or cannot be read.
8.A.4.2. Students are able to describe and represent relations using graphs	Graph is exceptionally well designed, neat, and attractive. A ruler and graph paper (or graphing computer program) is used.	Graph is neat and relatively attractive. A ruler and graph paper (or graphing computer program) is used to make the graph more readable.	Line is neatly drawn but the graph appears quite plain.	Graph appears messy and “thrown together” in a hurry. Line is visibly crooked.
Units on graph	All units are described (in a key or with labels) and are appropriately sized for the data set.	Most units are described (in a key or with labels) and are appropriately sized for the data set.	All units are not described (in a key or with labels) OR are not appropriately sized for the data set.	Units are neither described NOR appropriately sized for the data set.
8.A.4.1. Students are able to create rules to explain the relationship between numbers when a change in the first variable affects the second variable.	Rule accurately represents the data and is written in standard form	Rule accurately represents the data but is not written in standard form	Rule represents some of the data.	Rule does not represent the data.
Calculation of normal body temperature from model	Uses rule to correctly calculate normal body temperature in degrees Celsius to the nearest tenth.	Uses rule to correctly calculate normal body temperature in degrees Celsius to the nearest degree	Calculates normal body temperature in degrees Celsius to within 5 degrees.	Does not calculate normal body temperature in degrees Celsius or calculates with an error over 5 degrees.

**Eighth Grade Algebra
Performance Descriptors**

Advanced	Eighth grade students performing at the advanced level: <ul style="list-style-type: none"> represent using 1st degree algebraic statements using integers, tables, and graphs, in order to justify solution(s).
Proficient	Eighth grade students performing at the proficient level: <ul style="list-style-type: none"> simulate situations using 1st degree algebraic statements using integers, tables, and graphs in order to determine solution(s).
Basic	Eighth grade students performing at the basic level: <ul style="list-style-type: none"> simplify, solve, and graph 1st degree algebraic statements using whole numbers.

**Eighth Grade Algebra
ELL Performance Descriptors**

Proficient	Eighth grade ELL students performing at the proficient level: <ul style="list-style-type: none"> solve algebraic equations involving rational numbers; use tables and graphs to justify solutions; read, write, and speak the basic language of algebra.
Intermediate	Eighth grade ELL students performing at the intermediate level: <ul style="list-style-type: none"> solve algebraic equations involving integers; use tables and graphs to determine solutions verbally or in writing; create numerical expressions from oral or written contexts; explain in mathematical terms the sequence of steps used in solving problems; given simple oral or written responses to directed questions on topics presented in class.
Basic	Eighth grade ELL students performing at the basic level: <ul style="list-style-type: none"> evaluate numerical expressions using integers; read tables and graphs; recognize and use basic algebraic terms; respond to yes or no questions and to problems presented pictorially or numerically in class.
Emergent	Eighth grade ELL students performing at the emergent level: <ul style="list-style-type: none"> respond to numerical (not word) problems using addition, subtraction, multiplication, and division; use a number line to solve simple problems involving integers; copy and write numerals and algebraic symbols; imitate pronunciation of numbers and mathematical terms; use non-verbal communication to express mathematical ideas.
Pre-emergent	Eighth grade ELL students performing at the pre-emergent level: <ul style="list-style-type: none"> observe and model appropriate cultural and learning behaviors from peers and adults; listen to and observe comprehensible instruction and communicate understanding non-verbally.

FAHRENHEIT vs CELSIUS

Student Work Samples



As you examine the samples, consider the following questions:

- In light of the standard/s addressed and the assessment tools provided, what evidence does the work provide that students are achieving proficiency in the knowledge and skills addressed by the standard/s for the task?
- Is the task/activity well designed to help students acquire knowledge and demonstrate proficiency? Is the task/activity clearly aligned with the standards? In what ways would you adapt the task/activity to better meet the needs of your students?

Student Work Sample #1

Page 1

Let $x = ^\circ\text{Fahrenheit}$

$y = ^\circ\text{Celsius}$

$$y = mx + b$$

$$m = .555 \text{ or } \frac{5}{9}$$

$$m = \frac{100-0}{212-32} = \frac{100}{180} = \frac{10}{18} = \frac{5}{9}$$

$$b = -17.777 \text{ or } \frac{160}{9}$$

$$y - 0 = \frac{5}{9}(x - 32) \rightarrow y = \frac{5}{9}x - \frac{160}{9}$$

$$y = \frac{5}{9}x + \frac{160}{9}$$

$$y = \frac{5}{9}(98.6) - \frac{160}{9}$$

$$y = \frac{493}{9} - \frac{160}{9}$$

$$y = \frac{333}{9}$$

$$y = 37$$

$$37^\circ\text{C}$$

$$y - 0 = \frac{5}{9}(x - 32)$$

$$y = \frac{5}{9}(x - 32)$$

$$x = \frac{9}{5}y + 32$$

$$C = \frac{5}{9}(F - 32)$$

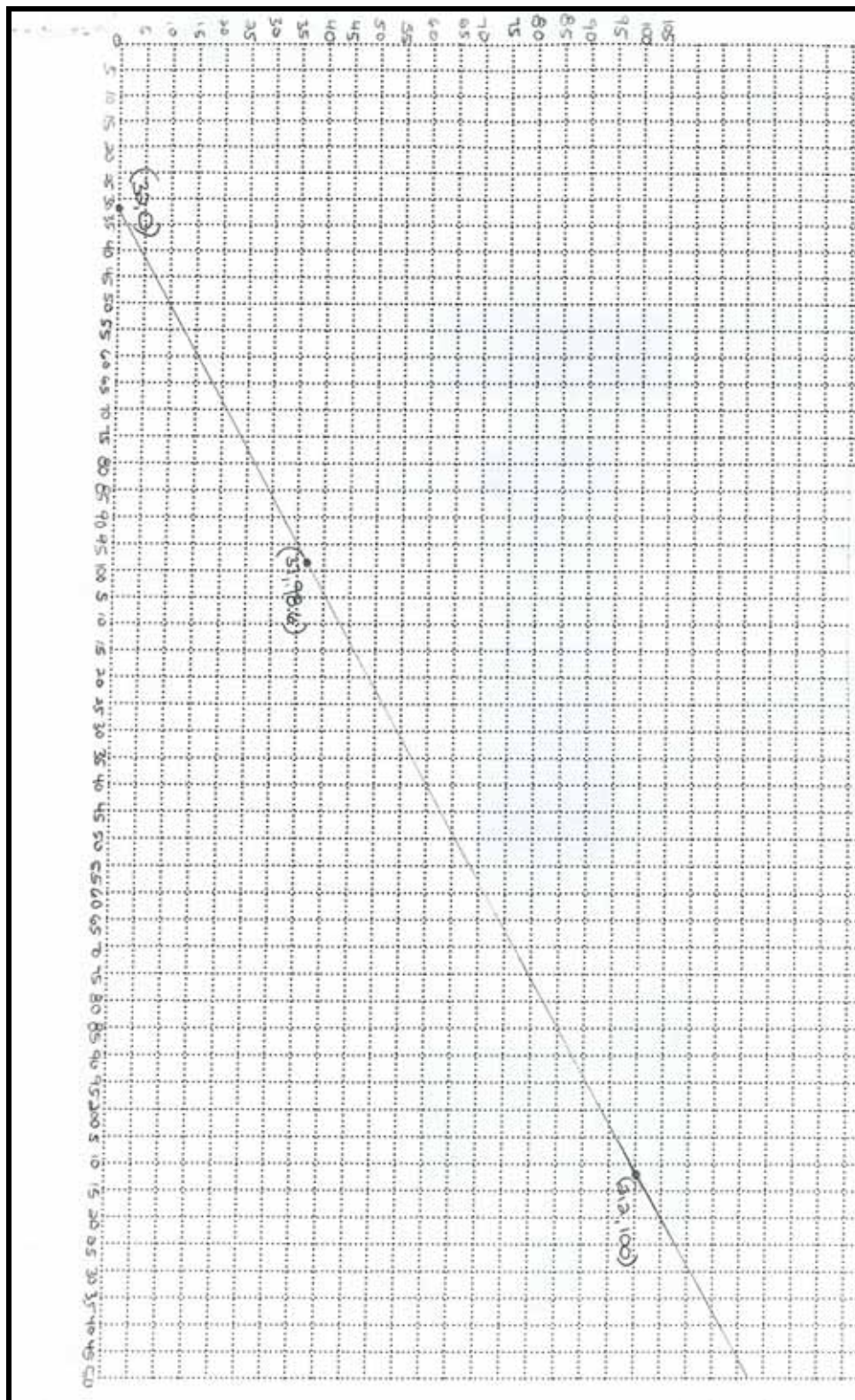
$$F = \frac{9}{5}C + 32$$

Celsius	Fahrenheit
0	32
37	98.6
100	212

a change of one $^\circ\text{Fahrenheit}$ is equal to a change of $\frac{5}{9}$ $^\circ\text{Celsius}$

a change of one $^\circ\text{Celsius}$ is equal to a change of $\frac{160}{9}$ $^\circ\text{Fahrenheit}$

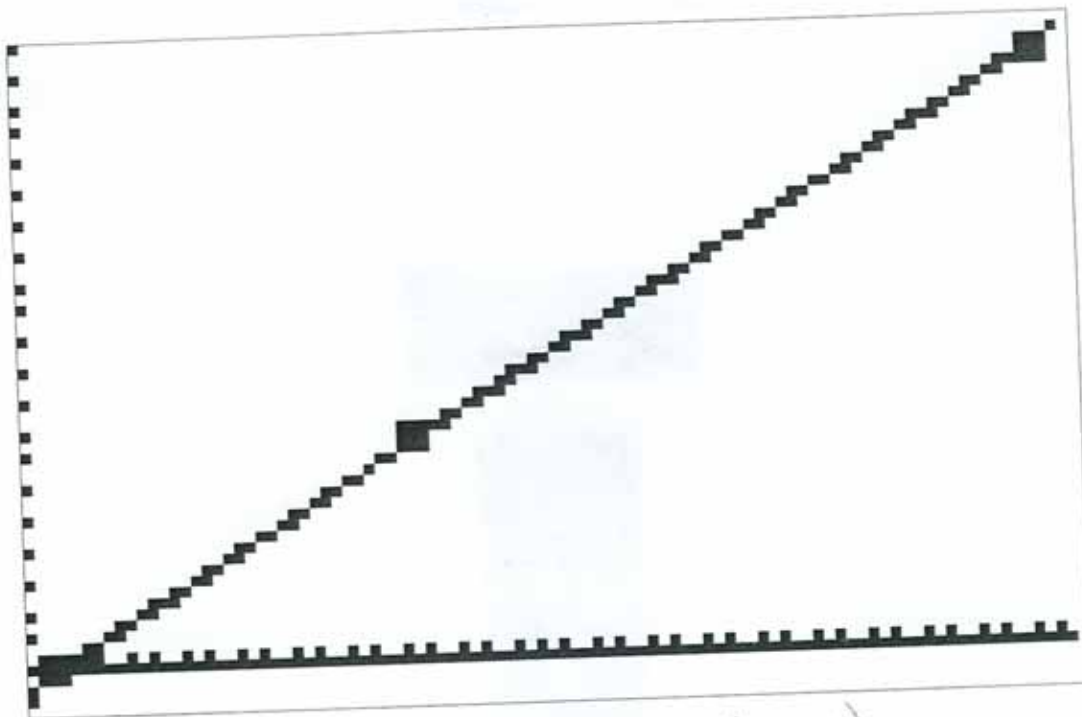
Sample #1 - Page 2



Looking at Student Work – Instructor notes and rating for work sample #1:

Category	Student Sample 1	Lead Teacher Comments
8.A.4.2. Students are able to describe and represent relations using tables	Advanced	The graph is neat and attractive but does not include labels or key. The rule is not written in standard form but list in slope-intercept form.
8.A.4.2. Students are able to describe and represent relations using graphs	Advanced	
Units on graph	Basic	
8.A.4.1. Students are able to create rules to explain the relationship between numbers when a change in the first variable affects the second variable.	Proficient	
Calculation of normal body temperature from model	Advanced	

Student Work Sample #2



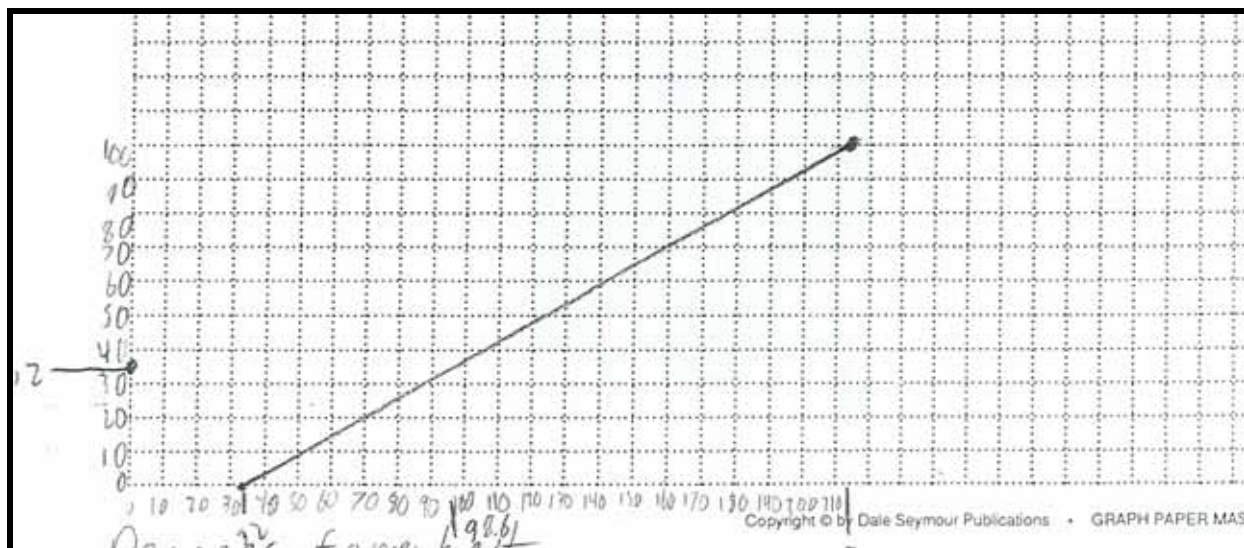
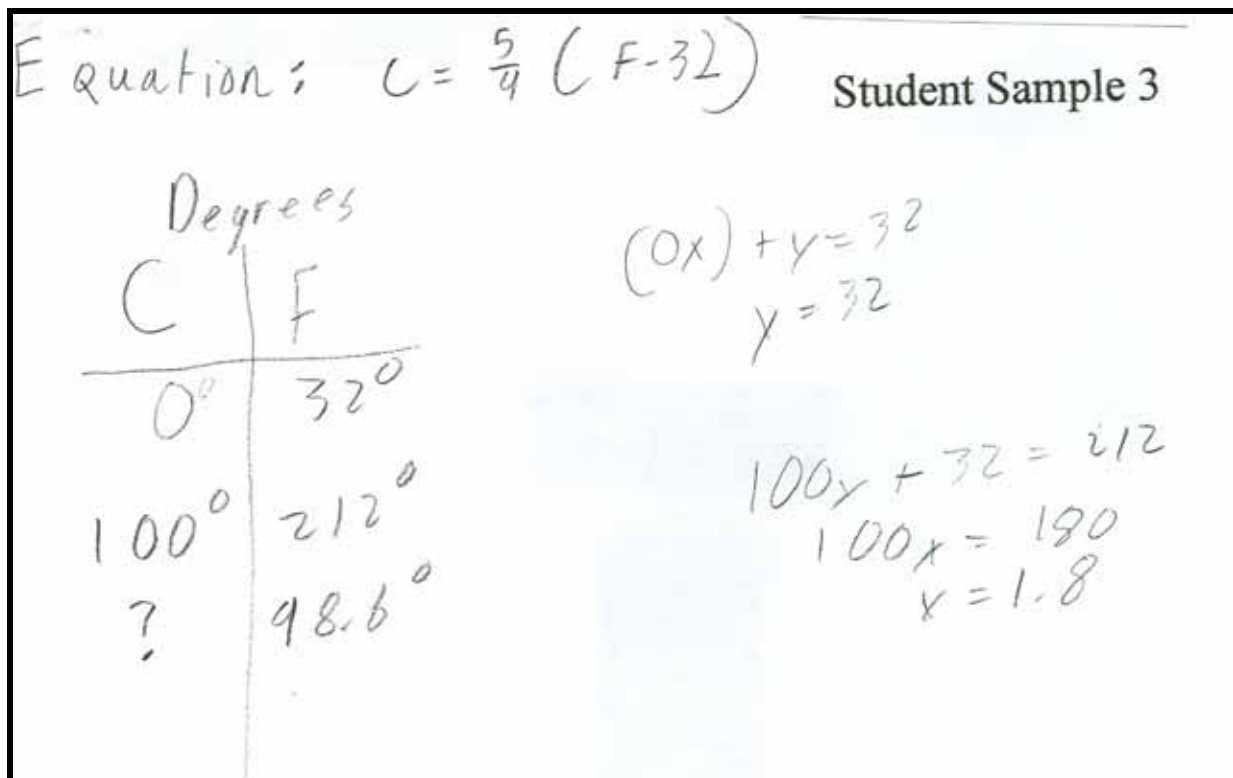
F	C
32	0
212	100
98.6	37

$$\begin{aligned}y - y &= m(x - x) \\x - 0 &= \frac{5}{9}(x - 32) \\y &= \frac{5}{9}(x - 32) \\y &= \frac{5}{9}(F - 32)\end{aligned}$$

Looking at Student Work – Instructor notes and rating for work sample #2:

Category	Student Sample 2	Lead Teacher Comments
8.A.4.2. Students are able to describe and represent relations using tables	Advanced	The graph is relatively attractive but not labeled. The units may or may not be appropriate. The rule is correct but not written in standard form.
8.A.4.2. Students are able to describe and represent relations using graphs	Proficient	
Units on graph	Below Basic	
8.A.4.1. Students are able to create rules to explain the relationship between numbers when a change in the first variable affects the second variable.	Proficient	
Calculation of normal body temperature from model	Advanced	

Student Work Sample #3



Looking at Student Work – Instructor notes and rating for work sample #3:

Category	Student Sample 3	Lead Teacher Comments
8.A.4.2. Students are able to describe and represent relations using tables	Proficient	The data in the table is organized and accurate. The graph is very plain and is not appropriately sized to give a good representation for the data set. The rule is correct but not written in standard form. The normal body temperature was not calculated
8.A.4.2. Students are able to describe and represent relations using graphs	Basic	
Units on graph	Basic	
8.A.4.1. Students are able to create rules to explain the relationship between numbers when a change in the first variable affects the second variable.	Proficient	
Calculation of normal body temperature from model	Below Basic	

INSTRUCTIONAL NOTES

Author Comments

This activity allows students to “see” that the temperature conversion formula that they use in Physical Science is not a magic formula, but that it is derived using mathematics.

Cultural Connections

Common units of measure used in other countries.

Interdisciplinary Connections

Physical Science or Biology – temperature conversions.

Resources

SD Mathematics Content Standards

<http://www.doe.sd.gov/contentstandards/math/index.asp>

SD Assessment and Testing

<http://www.doe.sd.gov/octa/assessment/index.asp>

The National Assessment of Educational Progress (NAEP)

<http://www.doe.sd.gov/octa/assessment/naep/index.asp>

National Council of Teachers of Mathematics

<http://nctm.org/>

Looking at Student Work

<http://www.lasw.org/index.html>